Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

AN INTERGLACIAL VALLEY IN ILLINOIS.

In this paper it is our purpose to trace the complex history of the present Embarras River valley, in southeastern Illinois, which lies partly on the newer Wisconsin drift and partly on the older Illinoian drift, crossing the terminal moraine of the former about midway of its course. North of the moraine the Embarras Valley is entirely postglacial, with little relation to any former valley. South of the moraine the youthful postglacial valley, as far as it extends, lies within a wider and more mature interglacial valley, which, in turn, usually lies within a still more mature preglacial rock valley.

There is evidence in Illinois and vicinity of several advances and retreats of the ice within the glacial period. During each retreat the melting of the ice freed rock waste, which had been carried along beneath the ice or frozen into the glacier, and deposited this waste as a sheet of till over all the land uncovered by the melting away of the ice. One of the oldest of these till-sheets is the Illinoian, now exposed over most of the southern and western parts of the state, but concealed by subsequent sheets in the northeast, the most extensive of which is the Wisconsin. In the southern two-thirds of the state the Illinoian and Wisconsin sheets are apparently the only ones represented, and their common boundary is the great terminal moraine, built during a prolonged halt of the ice-front at its farthest advance in the Wisconsin stage, and called here the Shelbyville moraine. The time between these two ice invasions, represented by the two drift layers, corresponds with two or more stages represented elsewhere by differentiable till-sheets, but known here only by erosion and weathering in the older drift. In other words, in southern Illinois, we have an old till-sheet extending far south, the Illinoian; a much younger till-sheet extending southward about to Paris, Mattoon, and Shelbyville, the early Wisconsin; and a strong terminal moraine lying along their common boundary. Fig. 1 shows the distribution of these features. For convenience the time between the two glacial stages mentioned may be called an interglacial epoch, remembering that in other places it may be broken up into several stages of advance with shorter interglacial stages.

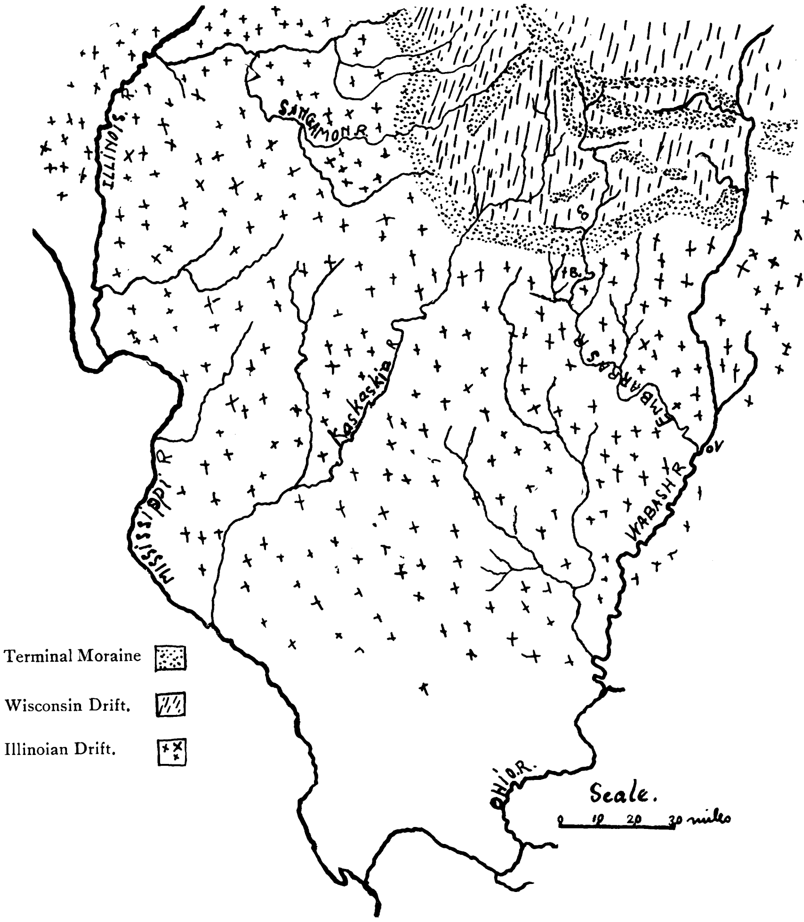

FIG. 1.—Cartogram showing distribution of Early Wisconsin and Illinoian Drift and the Shelbyville moraine and others, also the position of the Embarras River with reference to these areas. Initial letters for towns and cities mentioned in text. Adapted from Leverett, Ill. Glac. Lobe. Monog. 38, U. S. G. S.

Since the general slope of the state is from the north to the south, most of the streams flow in that direction, and of those taking their sources on the new drift several necessarily break through the terminal moraine and proceed across the old drift to the Wabash, Ohio, or Mississippi Rivers. Among these streams which rise within the moraine loop and find their way out through it is the Embarras, to which the study now turns Rising in several more or less swampy regions, or from tile drains in Champaign county, and receiving several small streams en route, the Embarras proceeds southward across the nearly level tracts of the Wisconsin drift-sheet, and through several minor terminal moraines, until it finally breaks through the large Shelbyville moraine south of Charleston in a clear-cut youthful gorge a hundred feet or more in depth. From this point it continues a more quiet, meandering stream across the plains of the Illinoian drift, to its debouchure into the Wabash River, near Vincennes, Indiana.

Through the early part of its course the Embarras makes its way, leisurely in dry weather, but rapidly in rainy weather, along open, stream-made ditches, or in semi-canals opened by dredging-shovels, in a channel not large enough to carry the flood waters. The stream can hardly be said to have a valley, only a channel, in this part of its course, but after twenty-five to thirty miles have been covered the ditch has become enlarged and a valley formed, which gradually becomes wider and deeper until the moraine is reached. During all this distance extreme youth is a chief characteristic; the valley walls are very steep—so steep, in fact, that landslides are common, and the side streams are short. The main valley attains a depth of seventy-five or eighty feet before it reaches the moraine and is cut in the drift; but occasionally bed-rock is reached, and at such places the valley often narrows to a few feet, and the stream goes through a little rock-floored gorge with rapids or tiny cascades. In the moraine the valley is perceptibly deeper, and near the southern margin of it attains a depth of over one hundred feet, while at several points within the ten or twelve miles through the moraine the water runs on a rock floor, being definitely constricted within a rock gorge at two points.

As the stream comes out upon the older drift, the valley decreases markedly in depth, and increases slightly in width.

The decrease in depth is due, of course, to the absence of the newer drift-sheet and its thickened border, the moraine; the slight increase in width may doubtless be ascribed to the same cause. The valley continues to widen as the stream increases in size, but does not deepen much in the fifty-mile remainder of its course. Its fall is about that of the general slope of the land. Very rarely does the stream touch bed-rock, and at no point is the valley perceptibly constricted because of encountering the more resistant layers. In low water the stream quietly meanders along to its mouth. At a number of points within the first ten miles south of the moraine opposite valley bluffs are apparently of different heights. This was discovered to be due to the fact that the present gorge-like valley is within an older, more mature valley, whose sides are reached by the inner valley only on the east, and not continuously there. Hence along the west side there are practically two continuous bluffs, the inner one being from a few rods to three-fourths of a mile within the outer one. But on the east side the stream has pushed its inner bluff much nearer the outer one, reaching it at a number of points and blending with it in one continuous descent from the uplands to the present flood-plain. Where this stage has not been reached there are two bluffs on the east side, as on the west, but they are rarely far apart. When the bluffs have coalesced on one side and not on the other, opposite bluffs seem to stand at discordant levels. Fig. 2 illustrates the case. The second or outer bluffs often have a scarp nearly as steep as will stand, say 20–25°, but are usually of gentler slope.

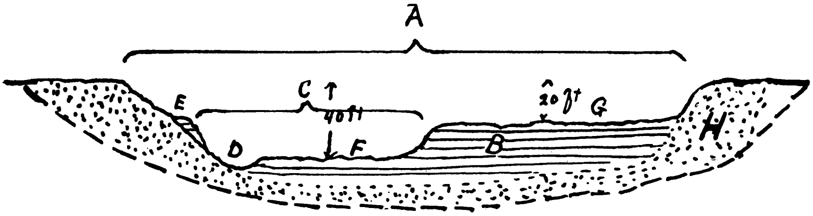

FIG. 2.— - - -, supposed boundary of preglacial valley; *A*, interglacial valley filled with; *B*, Wisconsin overwash material; *C*, present valley — postglacial; *D*, present stream bed; *E*, remnant of terrace on east side; *F*, present flood plain; *G*, second bottoms; *H*, Illinoian drift sheet. Vertical exaggeration about 25.

In the latitude of Bradbury, some three miles south of the outer margin of the moraine, the second bluff attains nearly the same height above the first as the first does above the stream. Farther north the first bluff rises higher with reference to the stream and the outer bluff, until, near the moraine, the second becomes almost imperceptible, while farther south the first gradually decreases in height until it becomes practically *nil*. Fig. 2 is a cross-section, somewhat idealized, about opposite Bradbury, at a point where the two eastern bluffs coalesce. Fig. 3 is a bird's-eye view much conventionalized, of the conditions along the west side of the stream, as discussed above.

What is the relation of all this to glaciation? Evidently there are two periods of erosion represented. Is one postglacial? Where, in time, is the other? The nature of the materials in the two sets of bluffs and their relation to surrounding features alone can solve the problem.

Certainly there must be a preglacial valley somewhere near this present stream, unless the whole plan of the preglacial drainage has been upset. The Ohio, Mississippi, Illinois, and lower Wabash in this latitude are, in general, about where they were in preglacial time; hence the general direction of other large streams must be similar to that of their earlier courses, but they are not necessarily in exactly the same beds. The older drift, according to the records of borings and coal shafts, and the exposed sections in stream and railroad cuts, is from twenty to fifty feet thick, rarely more, often less. Between the outer or second bluffs which continue down the stream is a valley, increasing from a mile to three miles in width, and in the deeper portion of its cross-section about fifty feet deep, rarely revealing bed-rock in its floor or sides. Both are practically of continuous drift, corresponding in composition, physical characteristics, and state of weathering with the general drift-sheet on either side. The valley may be followed for fifty to sixty miles with no material change of character, so far as these features are concerned.

There are three time-periods to be considered in the solution of the origin of the valley in question. First, is it a preglacial valley? Second, was it formed since the retreat of the last ice-sheet? Third, is it interglacial, formed after the advance of the ice that left the Illinoian and before that which left the Wisconsin drift? If it can be shown that the valley is neither preglacial nor postglacial, but is subsequent to the deposition of the Illinoian drift and prior to that of the Wisconsin, its position will be established. The three possibilities will be taken up in the order mentioned.

Since this valley, walled by the second bluffs, is cut in the Illinoian drift-sheet, it must have been formed subsequent to the laying down of that till-sheet. The character of the walls also precludes the possibility of its being due to rejuvenation just prior to the first advance of the ice, as may be the case with those gorges cut in rock, but more or less filled with drift of a late age, such as have been reported in New York. Again, since the valley is so rarely cut down to bed-rock, when the latter is usually very near the surface outside the valley, it is probably in a preglacial, well-matured valley, whose limits are reached only when the present valley encounters ledges. Furthermore, since the valley in the Illinoian drift apparently lies within the preglacial valley, the latter must have been nearly, but not completely, filled and obliterated by the drift-sheet of this early ice invasion. Had it been completely filled, how could the stream now be so continuously within it? It is also true that no large percentage of the drift-filling has been subsequently removed, else the walls of the preglacial rock valley would have been more frequently discovered. Likewise, it is reasonable, if not imperative, to suppose

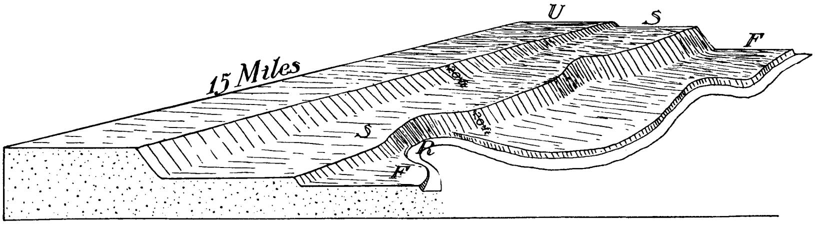

FIG. 3.—Looking N. W. from above east bluff at south end of the Wisconsin overwash in the interglacial valley. R = Embarras River, F = present flood plain, S = "second bottoms"—the terrace top, U = upland surface. Vertical scale very greatly exaggerated.

that when the valley in the Illinoian drift was first formed it extended to a greater depth than the present stream has cut, because the latter, in the few miles of double gorge, is not yet running on Illinoian drift, not having succeeded in cutting through a subsequent filling of the valley in the Illinoian.

This leads to a consideration of the nature of the inner, lower bluffs which accompany the present stream some miles beyond the terminal moraine, and are represented by the second bottom terrace front in Fig. 3, *S*. They are of gravels and sands and, farther south, clayey, fine sands, and partially sorted and stratified drift material corresponding in composition and stage of weathering with that of the earlier Wisconsin, being similar also to deposits on the uplands spread out as an apron in places along the southern margin of the moraine. The second bottoms between the inner and outer bluffs on each side of the stream, where they are not blended into one bluff, are made of the same materials. Wells, on these bottoms, show a section of the same materials to a depth of fifteen to thirty feet. No deeper wells were found in it. Furthermore, the relation of this terrace material, thick near the moraine and feathering out to nothing southward, points to the same conclusion—namely, that the materials of the walls of the inner gorge are layers of overwash material carried out beyond the terminal moraine by the overloaded stream flowing from the melting ice, and deposited by that stream in order to aggrade its course, and thus increase its carrying power to a strength equal to its remaining load. Since this material is of Wisconsin age and is laid down within a valley already formed, that valley cannot be postglacial. The third and only remaining alternative is that the valley represented by the outer bluffs is one formed between the deposition of the Illinoian and that of the Wisconsin drift-sheets, and hence may be called an interglacial valley. Its width and general maturity differentiate it from the known postglacial valleys, while its relative lack of greater maturity, even though in unconsolidated materials, declares it not to belong to the preglacial drainage. The same facts speak for an interglacial time period considerably longer than the postglacial period has been.

Subsequent to the formation of the overwash plain in the interglacial valley and the associated retreat of the ice, the habit of the stream has been changed, because its load has been greatly reduced. Probably its volume has also been somewhat cut down, but not to correspond with the reduction in burden; hence, whereas the stream was aggrading its course during the Wisconsin stage, it has been degrading during the postglacial stage, and has so far succeeded in removing the previously deposited material that the stream now flows in a gorge, a half mile or more in width. The stream is still widening this valley, and the second bottoms (Fig. 2, *G*) still remain to be removed.

The second bottoms constitute terraces of better agricultural soil than that of the vicinal upland. They correspond in orign with those described by early writers in many New England valleys, and especially those in the Connecticut and tributaries so thoroughly studied recently by Professor W. M. Davis. They may be correlated with many terraces in Illinois valleys, because nearly all streams heading on the new drift and flowing out through the moraine are terrace-bordered. The conditions differ to some extent from those reported by Professor Davis in that the postglacial excavation has not proceeded sufficiently as yet to encounter the walls and floors of the old valley. Therefore there are no defending ledges, no series of terrace steps, and very few cusps. The stream has cut back as far, or a little farther, each time than on the previous swing, and hence there is one long step from the second bottoms or terrace-top to the present flood-plain. It is unfortunate that more attention has not been given to the terraces of the Illinois, Iowa, and Wisconsin streams. There are many such terraces, and no doubt a careful study of them would yield valuable returns.

Summary.—The history of the present Embarras River valley is a complex one. North of the moraine it is entirely postglacial, and probably bears little relation to its precursor of interglacial time, still less to the preglacial valley. Very likely near the moraine and in it where the valley is deepest the stream has cu its recent channel mostly in the filling of a former valley, but the occurrence of occasional rock-ledges witnesses to the errors of the stream in attaining its former course. Farther back from the moraine, even to the stream's sources, the drift is so deep and the channel is so shallow that the absence of bed-rock in the bottom of the valley proves nothing as to the position of the earlier stream and its valley. South of the moraine the till is much thinner, and a valley with such depths as those of the Embarras would often, if not almost constantly, reach bed-rock, were it not within an earlier valley. Hence there was, first, a broad, well matured preglacial valley similar to those at present in nearby carboniferous rock in unglaciated parts of Indiana, Kentucky, and southern Illinois. Second, this valley was nearly filled with drift of Illinoian age. Third, after the retreat of the ice of the Illinoian stage and before the Wisconsin invasion, a valley was excavated in the above-mentioned filling. This probably extended some distance north of the present terminal moraine, possibly as far as the present sources of the Embarras. Fourth, this interglacial valley was partly filled with overwash material (entirely filled, north of the moraine, with drift) of Wisconsin age. And, fifth, the present youthful postglacial channel has been cut in the filling of the interglacial gorge, but the process has not gone far enough to reach bed-rock where the stream is fairly within the earlier valleys.

GEORGE D. HUBBARD.

CORNELL UNIVERSITY,
Ithaca, N. Y.